AHRQ Healthcare Horizon Scanning System – Potential High-Impact Interventions Report

Crosscutting Interventions and Programs

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Statement of Funding and Purpose

This report incorporates data collected during implementation of the Agency for Healthcare Research and Quality (AHRQ) Healthcare Horizon Scanning System by ECRI Institute under contract to AHRQ, Rockville, MD (Contract No. HHSA290201000006C). The findings and conclusions in this document are those of the authors, who are responsible for its content, and do not necessarily represent the views of AHRQ. No statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

This report's content should not be construed as either endorsements or rejections of specific interventions. As topics are entered into the System, individual topic profiles are developed for technologies and programs that appear to be close to diffusion into practice in the United States. Those reports are sent to various experts with clinical, health systems, health administration, and/or research backgrounds for comment and opinions about potential for impact. The comments and opinions received are then considered and synthesized by ECRI Institute to identify interventions that experts deemed, through the comment process, to have potential for high impact. Please see the methods section for more details about this process. This report is produced twice annually and topics included may change depending on expert comments received on interventions issued for comment during the preceding 6 months.

A representative from AHRQ served as a Contracting Officer's Technical Representative and provided input during the implementation of the horizon scanning system. AHRQ did not directly participate in horizon scanning, assessing the leads for topics, or providing opinions regarding potential impact of interventions.

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Financial Disclosure Statement

None of the individuals compiling this information has any affiliations or financial involvement that conflicts with the material presented in this report.

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Preface

The purpose of the AHRQ Healthcare Horizon Scanning System is to conduct horizon scanning of emerging health care technologies and innovations to better inform patient-centered outcomes research investments at AHRQ through the Effective Health Care Program. The Healthcare Horizon Scanning System provides AHRQ a systematic process to identify and monitor emerging technologies and innovations in health care and to create an inventory of interventions that have the highest potential for impact on clinical care, the health care system, patient outcomes, and costs. It will also be a tool for the public to identify and find information on new health care technologies and interventions. Any investigator or funder of research will be able to use the AHRQ Healthcare Horizon Scanning System to select potential topics for research.

The health care technologies and innovations of interest for horizon scanning are those that have yet to diffuse into or become part of established health care practice. These health care interventions are still in the early stages of development or adoption, except in the case of new applications of already-diffused technologies. Consistent with the definitions of health care interventions provided by the Institute of Medicine and the Federal Coordinating Council for Comparative Effectiveness Research, AHRQ is interested in innovations in drugs and biologics, medical devices, screening and diagnostic tests, procedures, services and programs, and care delivery.

Horizon scanning involves two processes. The first is identifying and monitoring new and evolving health care interventions that are purported to or may hold potential to diagnose, treat, or otherwise manage a particular condition or to improve care delivery for a variety of conditions. The second is analyzing the relevant health care context in which these new and evolving interventions exist to understand their potential impact on clinical care, the health care system, patient outcomes, and costs. It is NOT the goal of the AHRQ Healthcare Horizon Scanning System to make predictions on the future use and costs of any health care technology. Rather, the reports will help to inform and guide the planning and prioritization of research resources.

We welcome comments on this Potential High-Impact Interventions report. Send comments by mail to the Task Order Officer named in this report to: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by email to: effectivehealthcare@ahrq.hhs.gov.

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Background

Horizon scanning is an activity undertaken to identify technological and system innovations that could have important impacts or bring about paradigm shifts. In the health care sector, horizon scanning pertains to identification of new (and new uses of existing) pharmaceuticals, medical devices, diagnostic tests and procedures, therapeutic interventions, rehabilitative interventions, behavioral health interventions, and public health and health promotion activities. In early 2010, the Agency for Healthcare Research and Quality (AHRQ) identified the need to establish a national Healthcare Horizon Scanning System to generate information to inform comparative-effectiveness research investments by AHRQ and other interested entities. AHRQ makes those investments in 14 priority areas. For purposes of horizon scanning, AHRQ's interests are broad and encompass drugs, devices, procedures, treatments, screening and diagnostics, therapeutics, surgery, programs, and care delivery innovations that address unmet needs. Thus, we refer to topics identified and tracked in the AHRQ Healthcare Horizon Scanning System generically as "interventions." The AHRQ Healthcare Horizon Scanning System implementation of a systematic horizon scanning protocol (developed between September 1 and November 30, 2010) began on December 1, 2010. The system is intended to identify interventions that purport to address an unmet need and are up to 3 years out on the horizon and then to follow them up to 2 years after initial entry into the health care system. Since that implementation, review of more than 16,200 leads about potential topics has resulted in identification and tracking of about 1,900 topics across the 14 AHRQ priority areas and 1 cross-cutting area; about 500 topics are being actively tracked in the system.

Methods

As part of the Healthcare Horizon Scanning System activity, a report on interventions deemed as having potential for high impact on some aspect of health care or the health care system (e.g., patient outcomes, utilization, infrastructure, costs) is aggregated semi-annually. Topics eligible for inclusion are those interventions expected to be within 0–3 years of potential diffusion (e.g., in phase III trials or for which some preliminary efficacy data in the target population are available) in the United States or that have just begun diffusing and that have completed an expert feedback loop.

The determination of impact is made using a systematic process that involves compiling information on topics and issuing topic drafts to a small group of various experts (selected topic by topic) to gather their opinions and impressions about potential impact. Those impressions are used to determine potential impact. Information is compiled for expert comment on topics at a granular level (i.e., similar drugs in the same class are read separately), and then topics in the same class of a device, drug, or biologic are aggregated for discussion and impact assessment at a class level for this report. The process uses a topic-specific structured form with text boxes for comments and a scoring system (1 minimal to 4 high) for potential impact in seven parameters. Participants are required to respond to all parameters.

The scores and opinions are then synthesized to discern those topics deemed by experts to have potential for high impact in one or more of the parameters. Experts are drawn from an expanding database ECRI Institute maintains of approximately 350 experts nationwide who were invited and agreed to participate. The experts comprise a range of generalists and specialists in the health care sector whose experience reflects clinical practice, clinical research, health care delivery, health business, health technology assessment, or health facility administration perspectives. Each expert uses the structured form to also disclose any potential intellectual or financial conflicts of interest

(COIs). Perspectives of an expert with a COI are balanced by perspectives of experts without COIs. No more than two experts with a possible COI are considered out of a total of the seven or eight experts who are sought to provide comment for each topic. Experts are identified in the system by the perspective they bring (e.g., clinical, research, health systems, health business, health administration, health policy).

The topics included in this report had scores *and/or* supporting rationales at or above the overall average for all topics in this priority area that received comments by experts. Of key importance is that topic scores alone are not the sole criterion for inclusion—experts' rationales are the main drivers for the designation of potentially high impact. We then associated topics that emerged as having potentially high impact with a further subcategorization of "lower," "moderate," or "higher" within the high-impact-potential range. As the Healthcare Horizon Scanning System grows in number of topics on which expert opinions are received and as the development status of the interventions changes, the list of topics designated as having potentially high impact is expected to change over time. This report is being generated twice a year.

For additional details on methods, please refer to the full AHRQ Healthcare Horizon Scanning System Protocol and Operations Manual published on AHRQ's Effective Health Care Web site.

Results

The table below lists the five topics for which (1) some data on the intervention or technology were available for the intended target population; (2) information was compiled and sent for expert comment before October 27, 2013, in this priority area; and (3) we received six to eight sets of comments from experts between April 9, 2012, and October 29, 2013. (Eight topics in this priority area were being tracked in the system as of October 29, 2013, and five topics had received expert comments for consideration in this report).

We present summaries on four topics (designated by an asterisk in the table below), which were deemed to have high-impact potential on the basis of expert comments. The material on interventions in this Executive Summary and report is organized alphabetically. Readers are encouraged to read the detailed information on each intervention that follows the Executive Summary.

Priority Area 15: Crosscutting Interventions and Programs

Topic	High-Impact Potential
1. * Digital medicines (Proteus Digital Health Feedback System) for chronic conditions requiring long-term drug therapy	Lower end of the high-impact-potential range
2. * Hospital postdischarge clinics to provide transition care	Lower end of the high-impact-potential range
3. * Internet-based clinic electronic visits for diagnosis and treatment of simple conditions	Lower end of the high-impact-potential range
4. * Senior-specific emergency departments for treatment of elderly patients	Higher end of the high-impact-potential range
5. Sublingual patient-controlled analgesia system (Zalviso) for treatment of pain after major surgery	No high-impact potential at this time

Discussion

We created this priority area to capture crosscutting interventions that affect two or more of AHRQ's 14 priority areas. Some of these interventions are health care technologies and others are programs, services, or care-delivery innovations.

Digital Medicines (Proteus Digital Health Feedback System) for Chronic Conditions Requiring Long-term Drug Therapy

- **Key Facts:** The Proteus Digital Health™ Feedback System (Proteus Digital Health, Inc., Redwood City, CA), a form of "smart-pill" technology or "digital medicine," has been developed for use with oral pill or capsule medications prescribed for chronic diseases. The intention is to enable tracking of medication adherence in patients with conditions such as tuberculosis, diabetes, heart failure, AIDS, hepatitis C virus infection, and mental health disorders. The technology consists of an ingestible sensor (made of common food ingredients) embedded in the medication, a personal monitor, and a Bluetooth-enabled data device such as a cell phone. When the patient ingests the medication with embedded sensor, digestive fluids activate the sensor when it reaches the stomach. The personal monitor is a miniature, battery-operated, data-logging device in the form of a patch worn on the torso. It records heart rate, activity, ingestion of monitored medications, and patient-logged events such as symptoms. When ingested, the activated sensor transmits its unique signature to the personal monitor, which records and timestamps the event along with physiologic data, such as heart rate. The monitor transmits the data to the patient's Bluetooth-enabled cell phone or other computerized device. Encrypted data are forwarded to a secure database that clinicians can access to review the patient's status. In results of a trial of 111 patients who ingested 7,144 monitored pills, investigators reported that the system's positive and negative ingestible-marker detection accuracy was more than 97%, and medication adherence was more than 85%. The most common adverse effect was mild skin rash from the monitor patch's electrodes; no serious adverse events were reported. The company received marketing clearance from the U.S. Food and Drug Administration for the monitoring device in March 2010 and marketing clearance for the ingestible sensor in July 2012. The company is working with various pharmaceutical manufacturers to select medications for sensor integration and has also partnered with Oracle Health Sciences, which conducts trials on behalf of many pharmaceutical companies, to embed the technology in medications under development to obtain more complete results in clinical trials. Lack of patient adherence to the medication regimens being tested in clinical trials was cited in a recent Forbes magazine article as a significant reason that many phase II and III trials do not meet their endpoints.
- **Key Expert Comments:** Some experts commenting on this topic thought this technology could have a significant impact on many health system parameters if adopted. But some experts were skeptical about this technology's potential to improve medication adherence and health outcomes, because of the many variables affecting adherence (e.g., medication affordability, access, side effects). Some experts believe patient acceptance of the technology might be low, although one expert thought that elderly patients living alone might be more likely to adopt this technology. Some experts also thought clinician acceptance might be a barrier to adoption because the technology might increase time and infrastructure needed to review data and alter patient management as a result. Nonetheless, the technology was thought to be capable of providing data that could offer more insight into patient behavior regarding medication use. Experts thought that such insight might enable clinicians to explore with patients issues that the clinicians might not otherwise be aware of.
- **Potential for High Impact:** Lower end of the high-impact-potential range

Hospital Postdischarge Clinics to Provide Transition Care

- **Key Facts:** Postdischarge clinics are intended to increase access to care after hospitalization through a primary care-based, hospitalist-staffed approach to transitional care. Through various approaches, patients discharged from the emergency department (ED) or inpatient hospital setting are referred to a postdischarge clinic for an appointment within 2 days of discharge. At the postdischarge visit, the discharge worker reconciles medications, reviews medication use with the patient, arranges for prescriptions to be filled, assesses patients for any new symptoms, discusses pending test results, and schedules any necessary referral appointments. Case management, insurance status, and durable medical equipment needs are also addressed during these visits. Extensive time may be spent to educate the patient about self-diagnosis and personal health. The visit concludes with patients being referred to or reconnected with their primary care providers. The costs to establish and maintain a postdischarge clinic vary depending on the institution or health system's business model and existing resources. Postdischarge clinics can generate revenue for the parent facility through billing for patient visits.
- **Key Expert Comments:** Experts commenting on this intervention saw a need for providing prompt care after hospitalization, but had varying views on this intervention's potential to fulfill that need. Experts were particularly enthusiastic about the potential of this intervention to increase access to followup care for populations affected by health disparities and thought these populations could benefit the most from these visits. Experts also noted the potential for cost savings from a possible reduction in hospital readmissions.
- **Potential for High Impact:** Lower end of the high-impact-potential range

Internet-based Clinic Electronic Visits for Diagnosis and Treatment of Simple Conditions

- **Key Facts:** Internet-based clinic electronic visits are being used in certain parts of the United States to diagnose and treat simple conditions. Internet-based clinic staff are licensed medical providers such as physicians, nurse practitioners, and physician assistants. To use the services of an Internet-based clinic, the patient accesses the clinic's Web site to either complete a questionnaire (built from evidence-based medicine and using a special algorithm) on his or her symptoms or to use Web-video conferencing technology to meet with a provider. Some Internet-based clinics have the ability for either the provider or patient to initiate a phone call. The questionnaire and/or virtual meeting help the licensed health care provider make a diagnosis. A treatment plan based on the condition or disease is created specifically for the patient. Prescribed medications or therapies are sent electronically to the pharmacy of the patient's choosing. A program evaluation of one Internet-based clinic demonstrated an average $88 cost savings per electronic visit compared with a traditional in-office visit. Electronic visits are billed directly to the patient and/or third-party insurance. Availability of Internet-based clinics varies by location and Internet access in the United States.
- **Key Expert Comments:** Experts commenting on this intervention viewed this care process as having potential to address a significant unmet need regarding timely access to primary health care services. Experts noted the ability of this intervention to alleviate some demand on primary care physicians and to allow patients to access care in a more timely fashion before a simple acute condition evolves into a more serious acute situation. Experts' opinions on the potential for widespread acceptance and adoption by patients and providers

varied, in part because it relies on accessing the Internet and knowing how to use a computer. Experts noted the potential of this intervention to have a positive impact on health disparities if disparate populations have access to Internet and computers.

- **Potential for High Impact:** Lower end of the high-impact-potential range

Senior-Specific Emergency Departments for Treatment of Elderly Patients

- **Key Facts:** Some health systems are offering or planning to build EDs designed to cater to the special needs of the senior population (people aged 65 and older) to improve safety, outcomes, and quality of care and to reduce admissions and lengths of stay in intensive care units. Senior-specific EDs include new approaches to design, equipment, and processes of care that differ from standard EDs. Senior-specific EDs use furnishings and equipment designed to provide comfort, reduce injury risk, and enhance cognitive orientation. Reclining chairs and padded/lined stretchers are intended to improve patient comfort and reduce risk of pressure ulcers; large-faced clocks are used for better visibility and time orientation; calendars and boards with the names of hospital and clinical staff in large print are used to lower risk of patient disorientation and delirium; fall-prevention design provides nonskid floor surfaces, extra handrails, more aisle lighting, bedside commodes, and other visual and lighting aids. Protocol interventions include screening for cognitive impairment and delirium as part of regular clinical practice for early identification of patients at risk of having these conditions and to assist in disposition, treatment, or discharge planning; screening (as part of regular practice) for risk of adverse health outcomes, return visits, or hospitalization; practicing minimal use of urethral catheters to reduce risk for nosocomial infection; reducing use of "tethering" devices that limit patient mobility; and creating a position for a nursing discharge coordinator to improve continuity of care, decrease risk of return visits, and increase patient satisfaction.
- **Key Expert Comments:** Experts commenting thought that senior-specific EDs can address a very important unmet need. Experts were highly optimistic about the potential of these EDs to improve quality of life and health outcomes in elderly patients presenting at EDs. Experts suggested a positive disruption in care could result from senior-specific EDs including reduced lengths of stay, more appropriate hospital admissions, and improved diagnoses. Experts anticipated widespread adoption and acceptance of senior-specific EDs by hospital administrators, providers, and patients alike, although outfitting such EDs will require up-front investments in infrastructure, staff training, and staff recruitment of clinicians with geriatric expertise.
- **Potential for High Impact:** Higher end of the high-impact-potential range

Crosscutting Interventions and Programs

Digital Medicines (Proteus Digital Health Feedback System) for Chronic Conditions Requiring Long-term Drug Therapy

Unmet need: Patient adherence to prescribed medication regimens in the proper sequence, dose, and timing is one of several important factors in achieving effective medical therapy for patients with chronic diseases. According to the World Health Organization, the average medication adherence rate among patients with chronic diseases in developed nations is only 50%.[1] Also, patient adherence to prescribed drug regimens in clinical trials investigating new agents has been estimated to be as low as 50%. This creates problems in assessing a dose-response curve and establishing the maximum tolerated dose, and minimum effective dose. These issues are believed to affect the conduct and analyses of trial results.[2] Technologies are needed that could aid patient adherence to medication regimens for chronic diseases and be used in clinical trials to better understand safety, efficacy, and effectiveness and factors affecting medication adherence.

Intervention: The Proteus Digital Health Feedback System is a networked medication adherence-monitoring system—or digital medicine technology—intended to aggregate data on patient medication use (and health metrics) into tools that patients and health care providers can use to track and optimize adherence to recommended medication regimens.[3] According to developers, the intended purpose of this system is "to confirm the ingestion of individual oral medications and doses, to integrate this adherence data with physiological parameters and wellness metrics, to offer patient-directed sharing of health information with caregivers and providers, and to incorporate individualized behavior support tools."[4] Researchers state that one benefit of the system is its ability to improve providers' "knowledge of a patient's adherence."[4] With access to objective medication-adherence data, providers could determine whether their clinical management of a patient "should focus upon improving medication adherence, dose adjustment, drug substitution, or polypharmacy"[4] or other factors affecting adherence, such as cost or side effects.

The company has termed oral medications embedded with the sensor "digital medicines." Three main components comprise the system: the ingestible sensor, a personal monitor, and a mobile phone or Web-based communication platform.[5]

1. The ingestible sensor (formerly known as Ingestible Event Marker or IEM): a 1 mm^2 microfabricated chip sensor that a pharmaceutical manufacturer can embed into any oral medication. The company states that the sensor is made of "materials found in the food chain," such as silicon, copper, magnesium, minerals, and cellulose. When the patient swallows the sensor-embedded pill, the medication releases the chip, which is then activated by stomach fluids that power the sensor. Once activated, the sensor transmits digital information regarding the drug taken, its dose, and time of ingestion.[3,4] The system's wearable personal monitor captures the data, and after about 7 minutes of activation, the sensor becomes inactive and is subsequently excreted in the patient's feces.
2. The personal monitor: a wearable, adhesive, soft foam, skin-patch device (5 by 11 by 1 cm) that looks like an adhesive bandage and records information sent from the ingestible sensor. The monitor also records additional physiologic metrics, such as heart rate, respiration, activity, body position, and monitor-wearing compliance. The battery-operated monitor transmits this information via Bluetooth telemetry to a computing device and is designed to be worn for 7 days.[4,6]
3. The mobile phone or Web-based communication platform: a device used to view transmitted sensor data captured by the personal monitor. Encrypted data are sent

securely to either a mobile phone or Web-based platform for viewing by the patient, nonclinical caregivers, or health care providers.[4]

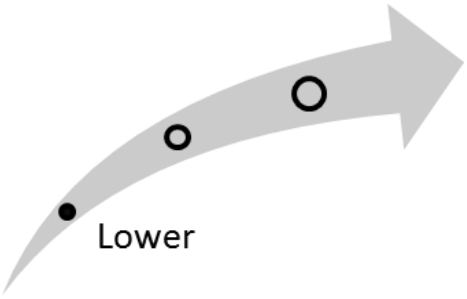
Clinical trials: Results were reported of a clinical trial of 111 subjects who ingested 7,144 ingestible markers. Investigators reported that "the system's positive detection accuracy and negative detection accuracy in detecting ingested markers were 97.1% and 97.7%, respectively. It differentiated 100% of multiple drugs and doses taken simultaneously by type and by dose. Medication adherence was >85%. The most common adverse effect was mild skin rash from the monitor's electrodes. No definitive marker-related adverse effects were reported."[4] The company has also made a strategic alliance with the company Oracle Health Sciences (Redwood Shores, CA), which runs global clinical trials "to work together in clinical trials exclusively to provide clinical investigators worldwide the ability to measure information about medication ingestion, dose timing, and associated physiologic response continuously and precisely for patients enrolled in clinical trials."[7] According to a recent article in Forbes magazine, this alliance is expected to have a significant influence on the success of pharmaceutical trials because "patient adherence to prescribed drug regimens is often as low as 50 percent. That undermines the statistical analysis of trial results and makes it difficult to determine the 'dose response curve,' which represents the maximum tolerable dose and the minimal effective dose. Failure to determine these thresholds during Phase 2 is believed to be one of the main reasons for Phase 3 failures."[2]

Manufacturer and regulatory status: Proteus Digital Health, Inc. (Redwood City, CA), makes the system. The manufacturer worked with the U.S. Food and Drug Administration (FDA) to determine the regulatory pathway because its components are regulated separately.[8] In March 2010, the manufacturer received 510(k) clearance from FDA to market the Raisin Personal Monitor (an earlier name) to record heart rate, activity, and patient-logged events.[9] In July 2012, FDA granted a 510(k) de novo clearance for the Proteus Ingestible Event Marker.[8] The application for the system was processed in accordance with the de novo provisions of the Federal Food, Drug, and Cosmetic Act for low-risk devices with no predicate.[8] The entire system is now available for sale and use in the United States; however, each medication embedded with the sensor is expected to be subject to FDA marketing clearance. In August 2010, the company received Conformité Européene (CE) mark approval to market the complete system, including the ingestible sensor and personal physiologic monitor, in the European Union.[10] The company announced collaborations with Novartis International AG and Otsuka Holdings Co., Ltd., to develop and commercialize digital medicines.[11]

Clinical Pathway at Point of This Intervention

Pharmaceutical manufacturers of oral medications can integrate this technology into FDA-approved oral pills and capsules and into medications under investigation in clinical trials. Patients would take oral medications embedded with the sensors as prescribed by a physician. Patients would be required to wear a monitoring patch on the skin and would be trained on how to access transmitted information using a computer or mobile-phone device. Clinicians could access objective, accurate, and timely data about patient adherence, to monitor patients' physiologic parameters, understand more about response to the medication, and prescribe any necessary adjustments in the regimen.[12]

Figure 1. Overall high-impact potential: digital medicines (Proteus Digital Health Feedback System) for chronic conditions requiring long-term drug therapy



Although a couple of experts who commented on this topic were skeptical about its potential to improve patient medication adherence and health outcomes, most experts commenting generally thought this intervention could have a significant impact on many health system parameters. These experts also wanted to see more data to ascertain whether this technology will fulfill its promise in improving patient health outcomes. Based on this input, our overall assessment is that this intervention is in the lower end of the high-impact-potential range at this time.

Results and Discussion of Comments

Seven experts, with clinical, research, health systems, and health administration backgrounds, offered perspectives on this intervention.[13-19] We have organized the following discussion of expert comments by the parameters on which they commented.

Unmet need and health outcomes: An important unmet need exists for ways to improve patient adherence to prescribed medication regimens, the experts agreed, and they thought that a monitoring system might be one tool to accomplish this. One clinical expert mentioned that about 50% of patients with chronic diseases experience prescription adherence issues.[16] One research expert highlighted the fact that prescription nonadherence can result in nearly $300 billion yearly in preventable health care expenses.[18] One clinical/community health expert stated that this intervention might be particularly useful in diseases in which medication adherence has a direct effect on public health, such as in cases of drug-resistant tuberculosis. But the experts also acknowledged that several other adherence variables (e.g., medication affordability, access, side effects) would not be addressed by digital medicines.

This device's potential to improve patient health outcomes is uncertain, the majority of experts thought. They cited a paucity of data at this point and uncertainty about its true impact on adherence. These experts were eager to see more and longer-term data.[13-19] One expert stated that the "active nature" of the system could keep patients more engaged in adhering to their drug regimens.[15]

Acceptance and adoption: Mobile device system requirements might hinder adoption by patients, most experts thought. One research expert explained, "Given the fact that patients will need to obtain the adherence monitoring system…and wear a personal monitoring device to capture the data transmitted by it, acceptance, at least at first, may not be universal."[18] Several experts cited cost as a potential barrier to patient adoption as well. However, one research expert envisioned this device being accepted by elderly patients, especially those living alone.[14] In terms of clinician acceptance, most experts agreed clinicians would initially view this technology as a burden, requiring them to spend more time on patient monitoring, followup, and education than they do now. One clinical expert stated, "This innovation may have the [p]otential to drive a wedge in the important clinician-patient relationship. The focus could shift from securing patient understanding

and ‘buy-in’ to a focus on family and friends to coerce the patient into compliance.”[17] One research expert explained that barriers to clinician adoption might be likely, given the added work in analyzing patient data, and that clinician acceptance might increase if reimbursement for this technology were available and if it saved health care costs by improving patient outcomes.[15]

Health care delivery infrastructure and patient management: Experts speculated that the technology has potential to affect patient case management, although they agreed that the various ways in which clinicians would intervene with patients who do not adhere to treatment recommendations remain to be seen. If the onus of improving patient adherence falls on the provider, staffing needs might increase because staff might need to spend additional time counseling nonadherent patients.

Experts suggested the technology would have minimal effect on health care costs if adoption is highly selective or limited; however, if adoption focuses on patients with the most complex medication regimens and most likely to have adherence issues, it could reduce care costs by averting health complications and hospitalizations. One research expert thought that if costs were comparable to this technology’s cost in the United Kingdom, roughly $80 per month, using the system would not greatly increase costs.[18] Another research expert opined that this technology “could potentially have a larger financial impact if more data show it can actually can cut costs by reducing complications through better adherence.”[15]

Health disparities: This technology is not likely to reduce health disparities, the experts generally agreed, citing per-patient costs associated with the system. Further, several experts thought this technology has potential to increase disparities between technology-naïve and technology-savvy patients. For example, one research expert opined that patients who are less “wired” or less receptive to using digital technology may have a harder time or resist using the technology.[15] A clinical and community health expert mentioned that this technology would most likely cater to “socially advantaged” populations, stating: “If the systems differentially improved adherences in advantaged populations, health care disparities would probably increase rather than decrease.”[13]

Hospital Postdischarge Clinics to Provide Transition Care

Unmet need: Discharge from hospital to a patient's home involves a transfer of responsibility of care from the inpatient provider to the patient, his or her home caregivers, and primary care or specialist physician.[20] The immediate post-hospital period at home is a vulnerable time for patients and can lead to high rates of health services use and health care spending. Ineffective planning and lack of an effective transition can lead to lapses in the quality of care, bad outcomes, readmission, and decreased patient safety.[20,21] During the transition, medications may be altered and self-care responsibilities increased. The National Institute for Health Care Reform reports that one-third of adults discharged from a hospital did not access followup care (with a physician, nurse practitioner, or physician assistant) within 30 days of discharge. Thus, a large unmet need exists to increase access to posthospitalization, transitional care.

Intervention: Postdischarge clinics, such as those at San Francisco General Hospital, CA, and Beth Israel Deaconess Medical Center, Boston, MA, focus on increasing access to posthospitalization care through a primary care–based, hospitalist-staffed approach to transitional care.

At the Bridge Clinic of San Francisco General Hospital, hospital residents refer patients to the clinic by text messaging a hospital-run system to set up the appointment. Residents are required to prepare a discharge summary immediately so it is available for the patient's clinic appointment. Before official discharge from inpatient care, patients receive a contact number for the clinic in case they need to reschedule the appointment or ask any questions. At the postdischarge visit, the discharge worker reconciles medications, reviews medication use, arranges prescription refills, assesses patients for any new symptoms, discusses pending test results, and makes any necessary referral appointments. The discharge worker also spends time educating patients regarding self-diagnosis and personal health promotion. Case management, insurance status, and durable medical equipment needs (e.g., walkers, special beds, chair lifts) are addressed. Finally, patients are referred to or reconnected with primary care providers.[22]

The postdischarge clinic at Beth Israel-Deaconess Medical Center is run in similar fashion. However, a computerized algorithm identifies patients for postdischarge clinic referral who have no listed primary care provider or for whom a followup appointment cannot be made with the listed primary care physician within 2 weeks of discharge. Visits at the clinic are 40 minutes long and consist of "reviewing the hospitalization, medication reconciliation, and outstanding tests."[23] The clinic staff may also schedule home health care services or skilled nursing facility care for patients. The majority of patients are seen at the clinic once and scheduled for a followup visit with a primary care provider. Patients discharged from the emergency department (ED) are scheduled for 30-minute appointments within 48 hours of the ED visit. Everything done at the clinic is documented and accessible via the medical center's electronic health record system.[23]

Clinical trials: Three studies evaluated different aspects and effects of postdischarge clinics. In one retrospective study, researchers evaluated the effects of postdischarge clinics on hospital readmission rates, ED visits, and mortality (within 30 days after initial hospital discharge). Investigators reported on patients (n=5,085) who were discharged from the hospital and had a followup visit at a postdischarge clinic (n=538), urgent care center (n=2,699), or primary care practice (n=1,848). As reported by the study authors, "Hospital length of stay (LOS) significantly varied between groups, with LOS 2.4 days shorter in [postdischarge clinic] (PDC) than primary care followup (PDC, 3.8 days; urgent care, 5.0 days; primary care, 6.2 days; p=0.04 between groups). Despite this, outcomes at 30 days were not statistically different between groups in unadjusted analysis (19.9% in PDC, 18.3% in urgent care, and 17.5% in primary care, p=0.42); there was

similarly no difference between PDC and primary care followup in propensity-adjusted multivariate analysis, adjusting for baseline differences between groups."[24]

In one prospective study, the length of time between hospital discharge and access to followup care was evaluated and compared between Beth Israel-Deaconess Medical Center's postdischarge clinic and primary care followup visits by Health Care Associates (HCA). Study authors reported, "The median duration from hospitalization to first visit was 7 days in the PDC and 15 days elsewhere in HCA (adjusted difference = 8.45 +/- 0.43 days; $P < 0.001$). From 2009 to 2011, among 10,845 discharges of HCA patients, patients were more likely to be seen within a week when the PDC was open than when it was closed…. Patients seen in a PDC based in a large academic primary care practice had far earlier followup than those seen elsewhere in the same practice, leading to a substantially greater proportion of all patients in the practice being seen within a week of discharge."[25]

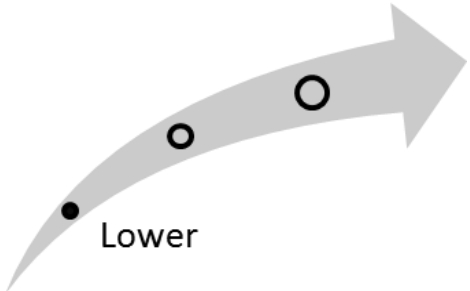
In an initial pilot study, researchers evaluated the show rate at the San Francisco General Hospital Bridge Clinic in addition to demographics of patients in terms of presence of an established primary care provider and health insurance coverage. Study authors reported, "During the pilot period, we had a 70 % show rate, with 78 patients seen in the clinic. The majority of patients did not have a primary care provider (88%) or access to health coverage (79%)."[26]

Program developers and funding: The number of postdischarge clinics across the United States has been increasing, possibly in response to Medicare rules preventing payment for readmissions within 30 days of discharge.[22,23,27] The inputs required and costs to establish and maintain a postdischarge clinic vary based on the specific hospital's needs and available resources. Developers of established postdischarge clinics have indicated that space and a dedicated support staff are needed for the operation.[23] Established postdischarge clinics generate revenue for the parent hospital through billing for patient visits.[22]

Current Approach to Care

Postdischarge clinics compete most directly with traditional primary care followup visits. Several other interventions may be used for postdischarge followup care, including providing more comprehensive discharge planning, having a medical professional make followup phone calls, ensuring the patient leaves with a followup appointment with a primary care practice, and sending an alert to the primary care provider notifying the provider that the patient has been discharged from inpatient care.[28] However, these interventions have not satisfied the unmet need for effective postdischarge, transitional care. As public payers like Medicare seek to limit reimbursement for readmissions within 30 days of discharge, health systems are seeking more innovative approaches to transitional care to prevent readmissions and improve patient health outcomes.

Figure 2. Overall high-impact potential: hospital postdischarge clinics to provide transition care



Experts commented that the unmet need is great to provide prompt postdischarge care, but views were mixed on the potential for this intervention to fulfill that need. Experts commented on the lack of data at this time to show the impact of postdischarge clinics on readmissions and patient outcomes relative to other strategies. However, experts were particularly enthusiastic about the ability of these clinics to increase access to followup care for health disparate populations, citing these populations as most likely to benefit. Experts also noted the potential for cost savings by averting hospital readmissions. Based on this input, our overall assessment is that this intervention is in the lower end of the high-impact-potential range.

Results and Discussion of Comments

Six experts, with clinical, research, and health systems backgrounds, offered perspectives on this program.[29-34] We have organized the following discussion of expert comments by the parameters on which they commented.

Unmet need and health outcomes: A great need exists to provide transitional care after hospitalization, particularly to reduce 30-day hospital readmission rates, the experts generally agreed. But their views were mixed on the potential for these clinics to meet this unmet need. Some experts thought the intervention's ability to provide rapid followup care could prevent relapses and ensure recovery. One clinical expert noted that patients with complex diseases could benefit in particular because "the current system has no means of aiding patients like these with health care professionals and instead relies entirely on the patient and the family."[29] Another expert with a research perspective concluded, "Providing more rapid follow-up [care] may be important in keeping patients more engaged in their care and more likely to follow discharge guidelines and recommendations."[31] However, other experts thought the intervention lacked substantial and high-quality data at this point to demonstrate positive impact on health outcomes and readmissions.

Acceptance and adoption: Clinicians would readily accept and adopt postdischarge clinics for transitional care, the majority of experts thought. The potential for reducing readmissions (and cost savings), enhancing coordination of care, and reducing complications, experts cited, would fuel widespread implementation of these clinics. However, a few experts suggested that funding and possible perceived intrusion on primary care physicians' scope of practice could be barriers to adoption. Patients would welcome the postdischarge clinic model, experts generally agreed. They noted that patients without regular access to care or established primary care providers would be particularly inclined to accept and use postdischarge clinic services.

Health care delivery infrastructure and patient management: Experts did not anticipate much disruption to health care delivery, except for the potential to direct services away from primary care physicians. Case management would be most affected, experts thought, in cases in which patients have no regular source of health care. Experts anticipated a postdischarge clinic could manage such patients more efficiently and effectively.

The potential for cost savings from reduced hospital readmissions would be the greatest area for potential cost impact with postdischarge clinics, experts suggested. The majority of experts concurred that cost savings from fewer readmissions could offset the initial cost of establishing a postdischarge clinic.

Health disparities: Postdischarge clinics could reduce disparities by increasing access to care in health-disparate populations, the majority of experts agreed. Patients without established primary care access are disproportionately of low socioeconomic status. One clinical expert remarked, "This intervention targets this population at a critical health care moment at the time when a patient is moving from the acute to subacute setting. This is a moment when a good number of negative outcomes could be avoided through coordinated care efforts."[29]

Internet-based Clinic Electronic Visits for Diagnosis and Treatment of Simple Conditions

Unmet need: Lack of access to health care can affect all aspects of a patient's life: quality, life expectancy, disease detection and treatment, disability, and overall physical, social, and mental health.[35] Having access to health care is contingent on an adequate supply of health care services, especially primary care providers, and the ability to obtain health care when wanted or needed.[36] Accessing health care can be problematic for patients who live long distances from providers or who lack transportation. Patients may also have social, cultural, linguistic, or financial barriers that make it difficult to seek or obtain care, and a shortage of primary care providers has increased the waiting time for appointments. Thus, a large unmet need exists for care delivery models that can extend health care to these populations.[37]

Intervention: We identified three proprietary brands of clinics that offer electronic visits for diagnosing and treating simple conditions. These clinics, independent of established primary care practices or health systems, are virtuwell™, Zipnosis, and NowClinic®. The programs have similar processes, with slight variations, such as conditions treated, hours of operation, and pricing of services.

To use an Internet-based clinic, the patient accesses a Web site platform that facilitates patient-clinician communication. In the cases of virtuwell and Zipnosis, the patient completes a questionnaire that uses an algorithm and evidence-based practices to assess patient responses and help the health care provider arrive at a diagnosis. A certified health care provider (i.e., board certified clinician, nurse practitioner, physician's assistant) reviews the assessment and delivers a treatment plan. Any necessary prescriptions are sent electronically to the pharmacy of the patient's choice.[38,40] For patients using virtuwell services, the health care provider can initiate phone calls; patients may also initiate a phone call with the provider during or after their online visits.[38]

The NowClinic varies slightly; instead of a questionnaire, the clinic uses Web-based cameras and secure live chat to conduct an appointment with a health care provider. NowClinic patients can view a list of providers who are online and available for an appointment and who can provide diagnosis and a treatment plan. Like virtuwell and Zipnosis, NowClinic offers real-time care through both the Internet and a telephone.[39]

Lists of diseases and conditions that can be diagnosed and treated by Internet-based clinics are posted on each clinic's Web site.[39-41] The conditions treated by Internet-based clinics have been generally associated with high diagnostic accuracy and treatment efficacy in traditional health care settings.[38] The conditions can be diagnosed without performing a physical examination, imaging studies, or laboratory tests.[38,40]

Clinical trials: We identified no ongoing trials or studies on this care model. Results of a program evaluation of more than 40,000 cases reported by the virtuwell clinic reported an average cost savings of $88 per episode of care, compared with cost of care received in the traditional setting for the same types of conditions. The authors also reported "strong indicators of clinical effectiveness and a 98 percent 'would recommend' rating from customers."[38] Formal studies would be needed to determine how this intervention affects patient effectiveness and safety.

Program developers and funding: Virtuwell was established in 2010 by HealthPartners® (Bloomington, MN); Zipnosis was established by Zipnosis, Inc. (St. Paul, MN); and NowClinic is a service of OptumHealth, a UnitedHealth Group company (Minneapolis, MN).[42-44] The administrative and operational resources required to establish and maintain an Internet-based clinic are similar to those of any health care business; an Internet-based clinic requires staffing and a Web-based platform. As such, the developer-associated costs of establishing and maintaining an

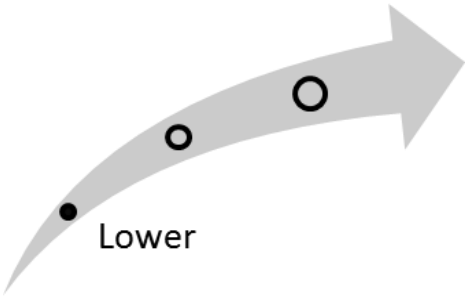
Internet-based clinic vary according to the business model. Established Internet-based clinics generate revenue by billing for electronic visits to either the patient or third-party payers or both. Charges vary between each Internet-based clinic and contracted reimbursement structures with third-party payers. In general, Internet-based clinics charge between $25 and $45 per electronic visit.[38-40]

Diffusion: Availability and access to established Internet-based clinics varies. NowClinic is available in Arizona, California, Connecticut, Illinois, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Mexico, New York, North Dakota, Ohio, Pennsylvania, South Dakota, Utah, Wisconsin, and Wyoming.[44] The developer has indicated plans to expand the service nationwide.[44] Zipnosis is a platform that entities can use to set up a virtual online clinic service.[43] Virtuwell is available to patients residing in Minnesota, Wisconsin, and Michigan.[45] As of a February 2013 report by Patrick Courneya et al., virtuwell had conducted more than 96,000 electronic visits; about 40,000 cases received a diagnosis and treatment plan and 56,000 cases were referred to in-person providers because they had conditions beyond the scope of the clinic.[38]

Current Approach to Care

Simple conditions are typically treated at traditional primary care practice offices, at nonurgent care clinics, via electronic visits with an established primary care provider, or through other telehealth programs. Internet-based clinics negate the need for a patient to travel to a physical location and are not associated with typical barriers to care, such as lack of transportation, long travel distance to a provider, lost time from work, lack of insurance, high cost, long wait times for an appointment, or communication barriers. To avoid misdiagnosis and for cases in which the patient's care requirements are beyond the scope of Internet-based clinic capabilities, patients are urged to seek in-person care.

Figure 3. Overall high-impact potential: internet-based clinic electronic visits for diagnosis and treatment of simple conditions



Overall, experts commenting on this intervention viewed Internet-based clinic visits as having potential to address a significant unmet need of access to health care services for simple conditions. Opinions on the potential for widespread acceptance and adoption of this intervention varied, although experts noted it has potential to alleviate some of the high demand for primary care physicians. Experts noted the potential of this intervention to positively affect patients experiencing health disparities due to access, time, cost, or age issues. Based on this input, our overall assessment is that this intervention is in the lower high-impact-potential range.

Results and Discussion of Comments

Six experts, with clinical, research, and health systems backgrounds, offered perspectives on this program.[46-51] We have organized the following discussion of expert comments by the parameters on which they commented.

Unmet need and health outcomes: Increasing access to health care is important, experts agreed, and most thought this intervention could increase access. They suggested patients would get more timely care for simple conditions, save time (e.g., travel and wait time), and reduce lost productivity (e.g., having to take off work to go to an appointment). Experts noted that Internet-based clinics are not associated with typical barriers to care that prevent access, although lack of access to computer technology and the Internet would be a barrier. One expert suggested the shortage of primary care physicians is limiting access to health care and Internet-based clinics can alleviate some of this need.[48] Some experts noted the ability of patients to access care sooner could prevent patients from getting sicker, thereby improving outcomes. One expert with a clinical perspective stated, "Although the Internet-based clinics will mainly handle patients with simple conditions; other patients will be able to be seen in the office [more quickly] (i.e. more room in the schedule for other patients if simple conditions are taken care of outside the office)."[48] However, some experts thought the narrow scope of diseases and conditions that can be diagnosed over the Internet limits the potential impact on patient health. In general, experts called for more substantial data proving the safety and effectiveness of this care approach.

Acceptance and adoption: Experts' views were mixed on how Internet-based clinics would be received by providers. Some experts thought some physicians would initially resist this care delivery innovation, perceiving it as competition and highlighting concerns of misdiagnosis and issues such as over-use of antibiotics. Other experts anticipated providers would find Internet-based clinics a welcome source of care to alleviate the burden on primary care providers. One expert with a clinical perspective remarked, "the key would be appropriate execution so the [patient] is getting appropriate treatment or appropriate referrals."[49]

The majority of experts indicated the intervention would be readily accepted and adopted by patients, particularly in rural areas or areas with limited access to care. Experts anticipated that patients who work long hours or live prohibitive distances from providers would be quick to use the Internet to receive care for simple conditions. Other experts suggested patients would prefer to see a provider face-to-face or already have loyalty to specific provider.

Health care delivery infrastructure and patient management: Internet-based clinics would lead to minimal disruption of the current health care delivery infrastructure and patient management, experts rated. Experts anticipated the most potential for disruption with this intervention would be in a reduction in primary care visits for minor conditions. Experts noted training and staffing requirements would generally not result in a shift of health care delivery. Overall, experts thought the Internet-based clinics would be used as an adjunct with little disruption to the current delivery infrastructure.

Health disparities: Internet-based clinics have the most potential to affect health disparities by improving access, experts concluded. One expert with a health systems perspective noted that "there are financial, cultural, access barriers and more that prevent disparate populations from seeking any type of health care. This could greatly improve access as at least these populations would be getting professional health advice."[50] Other experts provided this caveat: The impact on health disparities might be limited by the availability of computers and Internet access.

Senior-Specific Emergency Departments for Treatment of Elderly Patients

Unmet need: As the U.S. population ages, seniors (i.e., individuals aged 65 years or older) are increasingly seeking care in EDs. However, EDs are not typically optimally equipped to handle the unique needs of this population, and after an ED visit, seniors are at greater risk than before the visit of developing medical complications and functional declines and experiencing hospital readmissions, longer time spent in an intensive care unit when admitted, and poor health-related outcomes. EDs that are designed to address the special needs of the senior population might help address these challenges and improve care and outcomes for elderly patients in the ED.[52]

Intervention: Authors from several institutions have described models for senior-specific EDs, which are intended to "use specific interventions to improve patient satisfaction, comfort, and outcomes" in patients who are elderly.[52-54] Although approaches to constructing or repurposing an ED space for seniors vary, one model described by researchers at the Brookdale Department of Geriatrics and Palliative Medicine, Mount Sinai Medical Center (New York, NY) illustrates the kinds of design and approach (geriatric ED interventions [GEDIs]) that a senior-specific ED might entail.[52]

GEDIs can be divided into two main types: structural modification and protocol intervention.[52] (Other authors have described different categories; for example, the Northern Ontario School of Medicine of Sudbury and Thunder Bay, Ontario, Canada, developed a framework that divides interventions into those that address the physical environment, the social climate, hospital policies and procedures, and the health care system.)[55]

According to clinical researchers, structural GEDI modifications that will make an ED more "senior-friendly" include reclining chairs or padded or lined stretchers to improve patient comfort and reduce pressure ulcers; large-faced clocks for improved visibility; calendars; boards with the names of hospital and clinical staff to reduce risk of patient delirium; fall prevention measures such as nonskid floor surfaces, handrails, aisle lighting, and bedside commodes; and visual and lighting aids that might reduce risk of delirium.[52]

Clinical protocols that have the potential to improve the elderly patient's outcomes include screening for cognitive impairment and delirium as part of routine practice, to identify early the patients who are at risk for these conditions and to assist in disposition, treatment, or discharge planning. Also deemed important is routine screening for risk of adverse health outcomes, return visits, or hospitalization; minimizing use of urethral catheters and other "tethering" devices that reduce patient mobility and increase risk of nosocomial infection and delirium; and creating a staff position for a nursing discharge coordinator to improve continuity of care, decrease the need for return visits, and increase patient satisfaction.[52]

Clinical trials: A literature search yielded no recently completed trials reporting on use of senior-specific EDs. However, several institutions that have implemented senior-specific EDs have informally reported positive findings. Holy Cross Hospital (Silver Spring, MD) reported in January 2012 that one-ninth of patients of the hospital's geriatric ED "were prescribed five or more medications, and through the pharmacist referral, it was recognized that 20 percent of the population were taking inappropriate medications or doses."[56] Furthermore, the hospital reported, "Inpatient volume increased, signifying appropriate admissions and return emergency department visits within 72 hours decreased to 3 percent."[56]

Also, Dr. Mark Rosenberg, chairman of emergency services at St. Joseph's Regional Medical Center (Paterson, NJ), noted that, "a year after St. Joseph's opened its geriatric ER in 2009, the hospital's return rate for seniors who came back within 30 days of treatment for the same illness or

injury had decreased from 20 percent to less than 1 percent."[57] Dr. Andy Jagoda, emergency medicine chairman at Mount Sinai Hospital (New York, NY), reported that "up to eight elderly patients a month were falling in the regular emergency room…none have fallen in the geriatric E.R."[58]

Program developers and funding: Multiple hospitals across the United States have developed senior-specific EDs. Hospitals incorporating a senior-specific ED would be responsible for the cost of constructing/updating the ED, which varies based on the institution's needs and resources. For example, Newark (NJ) Beth Israel's facility, composed of eight beds, cost a reported $3.2 million.[59] However, Holy Cross Hospital stated that it spent $150,000 to create its senior-specific ED and that it raised the money through an annual fundraising event.[60] The hospital states that patients do not pay an extra fee to use the ED and its officials hope that the initial financial outlay will be recovered by reducing the rate of hospital readmissions.[60] Clinical services and tests conducted in the senior-specific ED are expected to be reimbursed according to normal insurance schedules and policies.

Diffusion: The prevalence of these EDs appears to be steadily growing. The first senior-specific ED in the United States was opened at Holy Cross Hospital in 2008.[61] St. Joseph's Healthcare System and Newark Beth Israel Medical Center opened geriatric EDs in 2009 and 2011, respectively.[59,62] No specific registry of senior-specific EDs in the United States exists; however, reports from health systems and health care news articles indicate that more than 50 have emerged across the United States since 2011, with an estimated150 in development.[63]

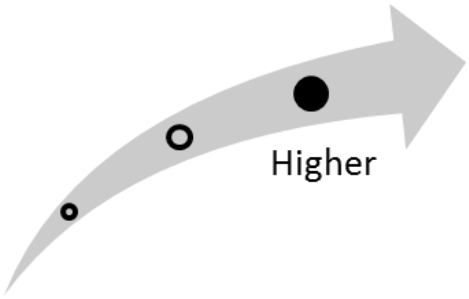
Current Approach to Care

Traditional EDs may incorporate cognitive screenings (usually administered on an as-needed basis to ED patients) and other geriatric clinical tools or best practices into routine examinations for seniors. However, to fully realize the goal of a senior-specific ED, staff need to work closely with other hospital departments and community health programs to ensure seamless transitions of care for elderly patients after discharge.

From a clinical point of view, traditional ED practice is not optimally suited for the senior population. For example, rapid triage and diagnosis—hallmarks of ED care—are difficult with older patients, who might have multiple comorbidities, polypharmacy, and functional and cognitive impairments. Clinical researchers state that these challenges, combined with the pressure to make rapid diagnoses, can increase the risk of incorrect or missed diagnoses. Further, in an effort to reduce fall risk and the time and energy devoted to cleaning bedpans or changing diapers, ED staff often insert bladder catheters into these patients, which increases patients' risk of developing delirium and infection.[52] Other design features that might pose a risk to the elderly include the narrow stretchers with thin mattresses that patients lie on while awaiting admission or tests. These mattresses can increase risk of a patient developing pressure ulcers. Fluorescent lighting and a lack of windows can promote disorientation in cognitively impaired older adults, and noise from monitor alarms, clinical staff, and other patients, can contribute to worsening delirium and communication difficulties in the potentially hearing-impaired population.[52]

Presently, a task force initiative comprising members from the American College of Emergency Physicians, Academy of Geriatric Emergency Medicine–Society for Academic Emergency Medicine, Education Networks of America, and The American Geriatrics Society is developing criteria for geriatric EDs.[64]

Figure 4. Overall high-impact potential: senior-specific emergency departments for treatment of elderly patients



Most experts commenting on this intervention agreed that senior-specific ED care represents an important unmet need. Although they did feel sufficient supporting data are lacking, experts were highly optimistic about the potential for improved quality of life and health outcomes in elderly patients being treated in this setting. Experts anticipated widespread adoption and acceptance of senior-specific EDs by hospital administrators, providers, and patients alike. Based on this input, our overall assessment is that this intervention is in the higher end of the high-impact-potential range.

Results and Discussion of Comments

Seven experts, with clinical, research, and health administration backgrounds, offered perspectives on this program.[65-71] We have organized the following discussion of expert comments by the parameters on which they commented.

Unmet need and health outcomes: The infrastructure of the traditional ED is ill-equipped to satisfy the special needs and demands of elderly patients, experts agreed. They cited architectural layout changes, lighting changes, and specialized staff as helping senior-specific EDs to fulfill this unmet need. Although supporting data are lacking, experts concluded the potential for improved quality of life and health outcomes in the target population is great with this care delivery innovation. Experts anticipated shorter lengths of stay, fewer medication errors, improved communication, and decreased patient anxiety and confusion would result from senior-specific EDs, compared with traditional EDs. Experts called for more concrete information on health outcomes and recommended that in-depth cost-benefit analyses be completed; however, they tempered this recommendation, saying that formalized studies on this invention would be difficult.

Acceptance and adoption: Experts generally agreed senior-specific EDs would be readily accepted and adopted by clinicians. However, two experts proposed the potential for initial resistance.[68,69] One expert with a clinical perspective suggested, "Some clinicians would be leery of working in a senior-specific ED because of [the] increase challenge of the elderly (being more complex, having atypical presentation, multiple medication use, medical complications, and high rate of poor outcomes)."[68]

Experts concluded the care delivery innovation would be widely accepted by patients and suggested elderly patients would gravitate towards hospitals offering this type of service.

Infrastructure and staffing: Experts highlighted the staff training and environment changes needed to implement this care-delivery innovation. Widespread implementation would result in an initial, positive shift in patient management, experts anticipated. They cited reduced lengths of stay, more appropriate hospital admissions, and improved diagnoses as contributing to this disruption. One expert with a clinical perspective viewed senior-specific EDs as beneficial to both elderly and younger patients, stating, "If the conventional emergency departments only have the younger patients that are less complicated, need less medical services/tests, and have better outcomes, there will be

lower through put times; decreasing the wait times and improve the patient's satisfaction."[68] This expert also suggested the senior-specific ED could potentially decrease inpatient stays by improved initial diagnosis through improved communication, which would also reduce unnecessary testing. Experts generally agreed the environment established by senior-specific EDs would facilitate improved communication and allow for better understanding of discharge instructions.

Initial costs for establishing a senior-specific ED could be high, experts agreed. Some experts thought these costs would be offset by reduced readmissions, reduced adverse events (e.g., falls), and improved health outcomes. Overall, experts did not anticipate that long-term costs would differ from those of the traditional ED.

Health disparities: Overall, experts stated the legal obligation of the ED to provide care to any patient regardless of ability to pay would negate any potential effects on health disparities. However, experts suggested that the up-front costs required to establish a senior-specific ED may result in adoption in more affluent areas. This would inversely affect senior citizens of health-disparate areas who may be unable to access care at those senior-specific EDs, some experts anticipated.

References

1. World Health Organization (WHO). Adherence to long-term therapies. Geneva (Switzerland): World Health Organization (WHO); 2003. 211 p. Also available: http://www.who.int/chp/knowledge/publications/adherence_report/en/.
2. Foley J. Ingestible sensors signal new era of digital medicine. [internet]. New York (NY): Forbes; 2013 Aug 30 [accessed 2013 Nov 18]. [8 p]. Available: http://www.forbes.com/sites/oracle/2013/08/30/ingestible-sensors-signal-new-era-of-digital-medicine/.
3. Proteus announces issuance of U.S. patent for ingestible digital devices. [internet]. Redwood City (CA): Proteus Biomedical, Inc.; 2011 Jul 14 [accessed 2012 Apr 3]. [2 p]. Available: http://www.proteus.com/proteus-announces-issuance-of-u-s-patent-for-ingestible-digital-devices/.
4. Au-Yeung KY, Moon GD, Robertson TL, et al. Early clinical experience with networked system for promoting patient self-management. Am J Manag Care. 2011;17(7):e277-87. PMID: 21819175
5. Proteus Digital Health completes $62.5 million financing. [internet]. Redwood City (CA): Proteus Digital Health, Inc.; 2013 May 1 [accessed 2013 Nov 18]. [2 p]. Available: http://www.proteus.com/proteus-digital-health-completes-62-5-million-financing/.
6. The chips that are good for your health. Pharmacy to sell edible microchips that will alert doctors if patients are not taking right medicines. [internet]. London: The Independent; 2012 Jan 17 [accessed 2012 Apr 3]. [8 p]. Available: http://www.independent.co.uk/news/science/the-chips-that-are-good-for-your-health-6290700.html.
7. Oracle invests in Proteus Digital Health and its FDA-approved ingestible sensor platform. [internet]. Redwood Shores (CA): Oracle; 2013 May 1 [accessed 2013 Nov 18]. [3 p]. Available: http://www.oracle.com/us/corporate/press/1941306.
8. Proteus Digital Health announces FDA clearance of ingestible sensor. [internet]. Redwood City (CA): Proteus Digital Health; 2012 Jul 30 [accessed 2012 Aug 6]. [2 p]. Available: http://proteusdigitalhealth.com/proteus-digital-health-announces-fda-clearance-of-ingestible-sensor/.
9. U.S. Food and Drug Administration (FDA). 510(k) summary for Raisin personal monitor [K093976]. [internet]. Washington (DC): U.S. Food and Drug Administration (FDA); 2010 Mar 25 [accessed 2010 Dec 27]. [10 p]. Available: http://www.fda.gov.
10. Proteus Biomedical announces European CE mark approval of ingestible sensor and monitor system. [internet]. Redwood City (CA): Proteus Biomedical, Inc.; 2010 Aug 13 [accessed 2010 Dec 29]. [2 p]. Available: http://www.proteus.com/proteus-biomedical-announces-european-ce-mark-approval-of-ingestible-sensor-and-monitor-system/.
11. Proteus Digital Health, Inc. and Otsuka Pharmaceutical Co., Ltd. announce worldwide agreement to develop novel digital health products. [internet]. Redwood City (CA): Proteus Digital Health, Inc.; 2012 Jul 5 [accessed 2013 Nov 18]. [2 p]. Available: http://www.proteusdigitalhealth.com/proteus-digital-health-inc-and-otsuka-pharmaceutical-co-ltd-announce-worldwide-agreement-to-develop-novel-digital-health-products/.
12. Technology. [internet]. Redwood (CA): Proteus Biomedical, Inc. [accessed 2010 Dec 27]. [1 p]. Available: http://www.proteusbiomed.com/technology/.
13. Expert Commenter 145. (External, Clinical). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Aug 22 [review date].
14. Expert Commenter 410. (ECRI Institute, Health Devices). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Aug 6 [review date].
15. Expert Commenter 418. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Jul 31 [review date].
16. Expert Commenter 423. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Jul 31 [review date].

17. Expert Commenter 447. (External, Health Systems/Administration). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Aug 31 [review date].

18. Expert Commenter 1175. (ECRI Institute, Applied Solutions Group). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Jul 31 [review date].

19. Expert Commenter 1181. (PRI, Research/Scientific/Technical). Horizon Scanning Structured Comment Form. HS262 - Intelligent pills (Raisin System) to monitor patient medication use in chronic diseases. 2012 Aug 15 [review date].

20. Kripalani S, Jackson AT, Schnipper JL, et al. Promoting effective transitions of care at hospital discharge: a review of key issues for hospitalists. J Hosp Med. 2007 Sep;2(5):314-23. PMID: 17935242

21. Naylor MD, Aiken LH, Kurtzman ET, et al. The care span: the importance of transitional care in achieving health reform. Health Aff (Millwood). 2011 Apr;30(4):746-54. PMID: 21471497

22. Newbold E, Schneidermann M, Horton C. The bridge clinic. Am J Nurs. 2012 Jul;112(7):56-9. PMID: 22739616

23. Doctoroff L. Interval examination: establishment of a hospitalist-staffed discharge clinic. J Gen Intern Med. 2012 Oct;27(10):1377-82. PMID: 22810356

24. Burke R, Whitfield E, Prochazka AV. Effect of a hospitalist-run post-discharge clinic on adverse post-discharge outcomes. In: Society of General Internal Medicine (SGIM) Annual Meeting; 2013 Apr 25-27; Denver (CO). Also available: http://www.sgim.org/File%20Library/SGIM/Meetings/Annual%20Meeting/Meetign%20Content/AM13%20presentations/Abstract-Session-B3-Organization-of-Care-and-Chronic-Disease-Management.pdf.

25. Doctoroff L, Mukamal K, McNally D, Vanka A, Yu R. Improving access with a hospitalist staffed post discharge clinic. J Hosp Med. 2012 Mar;7:S109-10.

26. Thomas L, Azari S, Chen B, et al. Pilot use of a discharge clinic to develop an educational experience in transitions of care for internal medicine housestaff. In: Society of Hospital Medicine Annual Meeting; 2012 Apr 1-4; San Diego (CA). Also available: http://www.shmabstracts.com/abstract.asp?MeetingID=783&id=97694.

27. Hospitals use post-discharge clinics to cut readmissions. [internet]. FierceHealthcare, Inc.; 2011 Dec 9 [accessed 2013 Aug 14]. [4 p]. Available: http://www.fiercehealthcare.com/story/hospitals-use-post-discharge-clinics-cut-readmissions/2011-12-09.

28. Greene J. The post-discharge dilemma. Hosp Health Netw. 2013 Jul;86(7):46-8. Also available: http://www.hhnmag.com/hhnmag/jsp/articledisplay.jsp?dcrpath=HHNMAG/Article/data/07JUL2012/0712HHN_FEA_continuum&domain=HHNMAG.

29. Expert Commenter 340. (External, Clinical). Horizon Scanning Structured Comment Form. HS1515 - Postdischarge clinics to provide transition care after hospital stay. 2013 Oct 16 [review date].

30. Expert Commenter 413. (ECRI Institute, Health Devices). Horizon Scanning Structured Comment Form. HS1515 - Postdischarge clinics to provide transition care after hospital stay. 2013 Oct 18 [review date].

31. Expert Commenter 418. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS1515 - Postdischarge clinics to provide transition care after hospital stay. 2013 Oct 18 [review date].

32. Expert Commenter 423. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS1515 - Postdischarge clinics to provide transition care after hospital stay. 2013 Oct 18 [review date].

33. Expert Commenter 1170. (ECRI Institute, Applied Solutions Group). Horizon Scanning Structured Comment Form. HS1515 - Postdischarge clinics to provide transition care after hospital stay. 2013 Oct 17 [review date].

34. Expert Commenter 1191. (External, Health Systems/Administration). Horizon Scanning Structured Comment Form. HS1515 - Postdischarge clinics to provide transition care after hospital stay. 2013 Oct 17 [review date].

35. U.S. Department of Health and Human Services. Access to health services - overview. In: HealthyPeople.gov [internet]. Washington (DC): U.S. Department of Health and Human Services [accessed 2013 Oct 2]. [4 p]. Available: http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicId=1.

36. Gulliford M, Figueroa-Munoz J, Morgan M, et al. What does 'access to health care' mean?. J Health Serv Res Policy. 2002 Jul;7(3):186-8. PMID: 12171751

37. Arora S, Kalishman S, Dion D, et al. Partnering urban academic medical centers and rural primary care clinicians to provide complex chronic disease care. Health Aff (Millwood). 2011 Jun;30(6):1176-84. Epub 2011 May 19. Also available: http://content.healthaffairs.org/content/early/2011/05/17/hlthaff.2011.0278.full. PMID: 21596757

38. Courneya PT, Palattao KJ, Gallagher JM. HealthPartners' online clinic for simple conditions delivers savings of $88 per episode and high patient approval. Health Aff (Millwood). 2013 Feb;32(2):385-92. PMID: 23381532

39. NowClinic online care: frequently asked questions. [internet]. Eden Prairie (MN): Optumhealth; 2012 Apr 6 [accessed 2013 Sep 30]. [8 p]. Available: http://mynowclinic.com/documents/common/pdfs/NowClinic%20consumer%20FAQ%204.17.12.pdf.

40. Zipnosis frequently asked questions. [internet]. St. Paul (MN): Zipnosis, Inc. [accessed 2013 Sep 30]. [2 p]. Available: https://www.zipnosis.com/faq.

41. Conditions we treat. [internet]. Bloomington (MN): HealthPartners, Inc. [accessed 2013 Sep 30]. [6 p]. Available: https://www.virtuwell.com/conditions.

42. About us: the virtuwell story. [internet]. Bloomington (MN): HealthPartners, Inc. [accessed 2013 Sep 30]. [2 p]. Available: https://www.virtuwell.com/aboutUs.

43. Zipnosis terms of use. [internet]. St. Paul (MN): Zipnosis, Inc.; 2009 Sep 24 [accessed 2013 Sep 30]. [8 p]. Available: https://www.zipnosis.com/tos.

44. NowClinic locations. [internet]. Eden Prairie (MN): Optumhealth [accessed 2013 Sep 30]. [1 p]. Available: http://mynowclinic.com/patient/locations/.

45. Contact virtuwell. [internet]. Bloomington (MN): HealthPartners, Inc. [accessed 2013 Sep 30]. [1 p]. Available: https://www.virtuwell.com/contact.

46. Expert Commenter 410. (ECRI Institute, Health Devices). Horizon Scanning Structured Comment Form. HS1942 - Internet-based clinic electronic visits for diagnosis and treatment of simple conditions. 2013 Oct 22 [review date].

47. Expert Commenter 421. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS1942 - Internet-based clinic electronic visits for diagnosis and treatment of simple conditions. 2013 Oct 21 [review date].

48. Expert Commenter 537. (External, Clinical). Horizon Scanning Structured Comment Form. HS1942 - Internet-based clinic electronic visits for diagnosis and treatment of simple conditions. 2013 Oct 22 [review date].

49. Expert Commenter 1026. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS1942 - Internet-based clinic electronic visits for diagnosis and treatment of simple conditions. 2013 Oct 22 [review date].

50. Expert Commenter 1245. (ECRI Institute, Applied Solutions Group). Horizon Scanning Structured Comment Form. HS1942 - Internet-based clinic electronic visits for diagnosis and treatment of simple conditions. 2013 Oct 23 [review date].

51. Expert Commenter 1246. (External, Health Systems/Administration). Horizon Scanning Structured Comment Form. HS1942 - Internet-based clinic electronic visits for diagnosis and treatment of simple conditions. 2013 Oct 22 [review date].

52. Hwang U, Morrison RS. The geriatric emergency department. J Am Geriatr Soc. 2007 Nov;55(11):1873-6. PMID: 17916122

53. Rosenberg M, Rosenberg L. Improving outcomes of elderly patients presenting to the emergency department. Ann Emerg Med. 2011 Nov;58(5):479-81. Epub 2011 Aug 4. PMID: 21816510

54. Seniors emergency center. [internet]. Silver Spring (MD): Holy Cross Hospital [accessed 2011 Oct 3]. [1 p]. Available: http://www.holycrosshealth.org/seniors-emergency-center.

55. Kelley ML, Parke B, Jokinen N, et al. Senior-friendly emergency department care: an environmental assessment. J Health Serv Res Policy. 2011 Jan;16(1):6-12. PMID: 20660532

56. Holy Cross Hospital geriatric emergency department case study. [internet]. Chicago (IL): Health Research & Educational Trust [accessed 2013 Oct 4]. [2 p]. Available: http://www.hpoe.org/resources/case-studies/1312.

57. Layton MJ. Jersey hospital's geriatric ER could be model for U.S. Star Ledger. 2013 Mar 26.

58. Hartocollis A. For the elderly, emergency rooms of their own. [internet]. New York (NY): New York Times; 2012 Apr 9 [accessed 2013 Oct 4]. [3 p]. Available: http://www.nytimes.com/2012/04/10/nyregion/geriatric-emergency-units-opening-at-us-hospitals.html?_r=0.

59. Lee E. Emergency room opens to care for seniors only. [internet]. Newark (NJ): The Star-Ledger; 2011 Nov 8 [accessed 2012 Feb 1]. [2 p]. Available: http:/ww.nj.com/starledger/.

60. Baker B. A Silver Spring ER aims to serve older patients. [internet]. Washington (DC): The Washington Post; 2009 Jan 27 [accessed 2011 Oct 3]. [3 p]. Available: http://www.washingtonpost.com/wp-dyn/content/article/2009/01/26/AR2009012601872.html.

61. Martin A, Rashidian N. Emergency rooms built with the elderly in mind. [internet]. New York (NY): The New York Times; 2011 Mar 14 [accessed 2011 Oct 3]. [8 p]. Available: http://newoldage.blogs.nytimes.com/2011/03/14/hospitals-building-emergency-rooms-for-the-elderly/.

62. Best practices: the geriatric emergency department, St. Joseph's Regional Medical Center. In: Urgent Matters. Volume 8, Issue 1 [internet]. Washington (DC): Robert Wood Johnson Foundation, the George Washington University School of Public Health and Health Services; 2011 Mar/Apr [accessed 2011 Oct 3]. [3 p]. Available: http://urgentmatters.org/media/file/vol%208.%20issue%202.BP.pdf.

63. Mulder JT. For older patients, a gentler emergency room. Post Standard. 2013 Jun 23.

64. Biese K, Hwang U. Geriatric emergency departments: fact, fiction or future? & how do we get there? In: Hartford/Association of Directors of Geriatric Academic Programs (ADGAP) Leadership Retreat; 2013 Jan 19; Cornado (CA). 2013 Jan 19.

65. Expert Commenter 403. (ECRI Institute, Health Devices). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 21 [review date].

66. Expert Commenter 418. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 21 [review date].

67. Expert Commenter 427. (ECRI Institute, Technology Assessment). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 24 [review date].

68. Expert Commenter 537. (External, Clinical). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 21 [review date].

69. Expert Commenter 938. (External, Health Systems/Administration). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 18 [review date].

70. Expert Commenter 1253. (ECRI Institute, Applied Solutions Group). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 24 [review date].

71. Expert Commenter 1256. (ECRI Institute, Select). Horizon Scanning Structured Comment Form. HS1253 - Senior-specific emergency departments for treatment of elderly patients. 2013 Oct 18 [review date].